DOCUMENT RESUME

ED 060 156 UD 012 221

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TITLE Cognitive Test Performance of Spanish-American Primary-school Children: A Longitudinal Study. Final Report.
INSTITUTION Kent State Univ., Ohio.
SPONS AGENCY National Center for Educational Research and Development (DHEW/OE), Washington, D.C.
BUREAU NO BR-0-E-148
PUB DATE Nov 71
GRANT OEG-5-71-0004(509)
NOTE 13p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Bilingualism; *Cognitive Development; Comprehension Development; Educational Diagnosis; *Elementary School Students; Ethnic Groups; Learning Difficulties; *Learning Disabilities; Longitudinal Studies; *Socioeconomic Status; Spanish Americans; *Spanish Speaking
IDENTIFIERS Bender Visual-Motor Gestalt Test; Illinois Test of Psycholinguistic Abilities; ITPA; Wechsler Intelligence Scale for Children; WISC

ABSTRACT

A twenty-six-month follow-up study was made of 75 Anglo- and Spanish-American primary school children who were examined on the Wechsler Intelligence Scale for Children, the Illinois Test of Psycholinguistic Abilities, and the Bender Visual-Motor Gestalt Test in order to determine the specific cognitive deficits which might account for the poor school performance of Spanish-American school children. After three years of schooling the children were found to be deficient in verbal comprehension but have no deficits in short-term memory, arithmetic, or perceptual organization. Bilingualism does not appear to be as important as ethnic status. There is some support for treating Spanish-American children as a single group. If they are to be subdivided, it is probably more important to consider the whole complex of variables making up the ethnic class rather than just bilingualism. Remedial efforts in the cognitive area with third and fourth grade Spanish-American children should concentrate upon vocabulary, general information, verbal analogies, experience with a wide range of social situations and their corresponding rules, verbal classifying procedures, and grammatical form. (Author/LM)

COGNITIVE TEST PERFORMANCE OF SPANISH-AMERICAN PRIMARY-SCHOOL CHILDREN: A LONGITUDINAL STUDY

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Seventy-five Ss, including Anglo-Americans, Spanish-American "monolinguals", and Spanish-American "bilinguals", were retested after 26 months on the WISC, Illinois Test of Psycholinguistic Abilities, and Bender Visual-Motor Gestalt Test in order to determine the specific cognitive deficits which might account for the poor school performance of Spanish-American school children. In 12 of 21 subtests there were no group differences. After three years of schooling Spanish-American school children are deficit in verbal comprehension but have no deficits in short-term memory, arithmetic, or perceptual organization. Bilingualism does not appear to be as important as ethnic status. There is some support for treating Spanish-American children as a single group. If they are to be subdivided, it is probably more important to consider the whole complex of variables making up the ethnic class (parental aspiration, value system, poverty level, and restriction of experience) rather than just bilingualism. Remedial efforts in the cognitive area with third and fourth grade Spanish-American children should concentrate upon vocabulary, general information, verbal analogies, experience with a wide range of social situations and their corresponding rules, verbal classifying procedures, verbal similarities and differences, and grammatical form.

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November 1971

The research reported herein was performed pursuant to a grant with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Office of Education
National Center for Educational Research and Development
(Regional Research Program)

Introduction

The present study was a 26-month follow-up of Anglo- and Spanish-American primary-school children who were examined first on the Wechsler Intelligence Scale for Children (WISC), the Illinois Test of Psycholinguistic Abilities, Experimental Edition (McCarthy and Kirk, 1961), and the Bender Visual-Motor Gestalt Test (Bender, 1946) at either the end of their kindergarten or first grade school year. The resulting data help clarify the development of specific assets and deficits of Spanish-American school children and help explain the reasons for their poor school performance. Specifically, the study focused on global score differences in three groups, specific subtest differences, bilingualism and sexual differences, and stability of performance over time.

Method

Subjects and Procedures

Previously (Killian, 1971), 84 Ss were selected on the basis of three variables: (a) language ability and ethnic group (Anglo-American monolinguals, Spanish-American monolinguals, and Spanish-American bilinguals), (b) sex, and (c) grade (just completed kindergarten or the first grade). The 3 X 2 X 2 design had 12 groups of seven Ss each. The children in the three language groups were matched on the basis of school achievement tests resulting in the restriction of the range of ability being measured. No measures of social class were made, but almost all of the Spanish children were from the lower class and most of the Anglo children were from the lower class. The children attended public schools in a rural community town of about 8000 inhabitants.

In one testing period lasting for about two hours, each child was given the Bender following the administrative and scoring system of Koppitz (1963), the Picture Arrangement, Block Design, Object Assembly, and Coding subtests from the WISC, followed by Information, Comprehension, Arithmetic, Similarities, and Vocabulary, a 10-minute "coke break", and then the entire experimental edition of the ITPA as directed by the manual. Not all children were given the WISC Similarities subtest -- some received the Picture Completion subtest in its place; however, all Spanish-American children did receive the Similarities subtest.

Seventy-five of the original 84 Ss were readministered the Bender, complete WISC, and the experimental edition of the ITPA in that order 26 months later by four experienced test administrators, two males and two females, during school hours. In most cases, each E had an equal number of Ss from each cell. As in the original testing, each child was tested in one sitting.

Analysis of Data

Raw scores and scaled scores were analyzed for the WISC and raw scores alone were analyzed for the Bender and the ITPA. In the original study there was a significant age difference between the three language groups. The use of raw scores gives an advantage to the Spanish-American Ss who were older by either three or six months (monolingual or bilingual); the use of scaled scores eliminates the age advantage.

Analyses were done on all post-test variables alone using a four-way classification analysis of variance design with the Ss being treated as a factor (Ss X Language Group X Sex X Grade).

The pretest results using the same design were already available. The pretest and posttest analyses taken separately allow for group comparisons at a particular period of time in a cross-sectional fashion. A five-way analysis was done on all variables which were used in both pretest and posttest periods. (Ss X Language Group X Sex X Grade X Pretest-Posttest). The 5-way analysis allows for a Group X Pretest-Posttest interaction effect which would indicate whether the three groups had changed differentially over time. The five-way analysis allows for longitudinal treatment of the data. Using Ss as a factor takes into consideration the correlation between the matched groups (McNemar, 1962, pp. 339-340; Winer, 1962, pp.289-291.)

Four p values were the main ones used in interpreting the results of the study. These values are given for every variable in Table 1, 2, and 3: (a) is the Language Group main effect value for the pretest alone, (b) is the Language Group main effect value for posttest alone, (c) is the Language Group X Pretest-Posttest interaction effect value, and (d) is the Language Group main effect value when scores on pretest and posttest are averaged and treated as one score. Although only these p values are given in the tables, all other main effect values and all possible interaction values were available and were interpreted when it was thought to be appropriate.

Fortunately, of the nine original Ss who were not retested, no two of them came from the same cell. Therefore three Ss were randomly dropped from the remaining cells leaving N = 72 for the present study: six Ss per cell, three Language Groups, two Sex Groups, two Grade Levels, and two Test Periods.

All pretest and posttest variables were intercorrelated and stability coefficients over the 26-month period were computed.

Results

Global Scores

Results of global score means are presented in Table 1. For WISC Verbal IQ there was no change over time. The Anglo-American Ss were superior to the two Spanish-American groups on pretest and again on posttest. The same pattern was found for the ITPA Language Age. On the WISC Performance IQ there was a pretest group difference, but upon posttest that difference disappeared, as did the group main effect for the average of the two test periods. Therefore, even though the group X pretest-posttest interaction effect was nonsignificant, change over time is indicated for Performance IQ. Since the WISC Full Scale IQ is a composit of Verbal and Performance IQ, the results should indicate some gain for Spanish-American Ss but not to the same extent as for Performance IQ. This pattern resulted as a previous group difference in Full Scale IQ disappeared at posttest; however, the interaction effect approached significance ($p < .12$) and the main overall effect was significant ($p < .01$).

These results indicate that Spanish-American school children, after three years of schooling, continue to have a WISC Verbal IQ deficit and an ITPA Language deficit, but have completely overcome a WISC Performance deficit. When verbal and performance IQ's are averaged for Spanish-American children they, of course, show a Full Scale IQ deficit.

Individual Subtest Scores

Tables 2 and 3 present the results of the 21 subtests given (18 both pretest and posttest and three posttest alone). There were no Spanish-American deficits on 12 of 21 subtests. There were no pretest nor posttest differences nor were there any changes in rate of growth over time for eight of the 21 variables (WISC Arithmetic, Digit Span, Picture Completion, Block Design, Coding, ITPA Motor Encoding, Visual-Motor Sequential, and the Bender). For three subtests, the Spanish deficit was eliminated (WISC Picture Arrangement, ITPA Auditory Decoding and Auditory-Vocal Sequential) and on one subtest the Spanish Children were superior (Object Assembly).

Those subtests in which there were group differences and the Anglo children were always ranked in the highest position were WISC Information, Comprehension, Similarities, Vocabulary, and ITPA Auditory-Vocal Association and Auditory-Vocal Automatic.

TABLE 1

Global Score Means

Group	Wechsler Intelligence Scale for Children						Illinois Test of Psycholinguistic Abilities			
	Verbal IQ		Performance IQ		Full Scale IQ		Language Age			
							1968		1970	
	1968	1970	1968	1970	1968	1970	Kinder-garten	First Grade	Third Grade	Fourth Grade
Anglo-American	99.9	97.3	96.8	96.9	98.2	96.9	6 - 2	6 - 8	8 - 3	8 - 11
Spanish-American monolingual	92.4	91.0	93.2	98.8	92.2	94.1	5 - 7	6 - 0	7 - 6	7 - 10
Spanish-American bilingual	88.3	89.1	89.9	95.7	87.9	91.5	5 - 4	6 - 1	7 - 6	7 - 9
	.001[a] NS[c]	.01[b] .003[d]	.05 NS	NS NS	.05 .12	NS .01	.001 NS		.03 .005	

Note: NS means p value greater than .15

a Group main effect p value for pretest only - 1968
b Group main effect p value for posttest only - 1970
c Group X Pretext-Posttest interaction p value
d Group main effect p value for pretest posttest analysis

TABLE 2

Mean Scaled Scores on the WISC

Group	Information		Comprehension		Arithmetic		Similarities		Vocabulary		Digit Span	
	1968	1970	1968	1970	1968	1970	1968	1970	1968	1970	1968	1970
Anglo-American	9.9	9.4	10.0	9.5	9.9	8.3	--	10.8	9.8	9.5	--	9.6
Spanish-American monolingual	8.4	8.5	7.3	7.8	9.8	8.4	9.4	10.0	9.3	8.1	--	9.0
Spanish-American bilingual	8.4	7.5	7.2	7.5	8.9	9.4	8.2	8.8	8.1	8.1	--	8.6
	.05[a]	.02[b]	.01	.09	NS	NS	.01	.10	NS	06	--	NS
	NS[c]	.01[d]	NS	.01	06	NS	--	--	.10	.03	--	--

Group	Picture Completion		Picture Arrangement		Block Design		Object Assembly		Coding	
	1968	1970	1968	1970	1968	1970	1968	1970	1968	1970
Anglo-American	--	9.8	9.8	9.7	9.9	9.3	9.6	9.6	9.2	9.3
Spanish-American monolingual	--	10.1	7.6	9.8	10.0	9.5	9.9	11.3	8.5	9.0
Spanish-American bilingual	--	10.4	6.8	8.7	8.8	8.9	9.1	9.4	9.1	9.5
	--[a]	NS[b]	05	NS	NS	NS	NS	03	NS	NS
	--[c]	--[d]	.08	.01	NS	NS	NS	NS	NS	NS

Note: NS means p value greater than .15.

a Group main effect p value for pretest only - 1968
b Group main effect p value for posttest only - 1970
c Group X Pretest-Posttest interaction p value
d Group main effect p value for Pretest-Posttest analysis

TABLE 3

Mean Mental Ages on the Illinois Test of Psycholinguistic Abilities Subtests and the Bender Visual - Motor Gestalt Test

Group	Auditory Decoding		Visual Decoding		Auditory-Vocal Association		Visual-Motor Association		Vocal Encoding	
	1968	1970	1968	1970	1968	1970	1968	1970	1968	1970
Anglo-American	7-3	8-10	7-6	8-9[e]	6-9	8-7	7-1	8-3	5-1	8-11
Spanish-American monolingual	6-0	7-11	6-5	8-9	6-5	7-3	6-5	8-3	4-11	6-11
Spanish-American bilingual	6-0	7-6	6-4	8-9[e]	6-3	7-3	6-2	7-8	5-1	7-9
	.01[a] .04[c]	NS[b] .07[d]	.05 NS	.03 .01	NS NS	.04 .08	NS NS	.08 .12	NS NS	.06 .07

Group	Motor Encoding		Auditory-Vocal Automatic		Auditory-Vocal Sequential		Visual-Motor Sequential		Bender Gestalt	
	1968	1970	1968	1970	1968	1970	1968	1970	1968	1970
Anglo-American	6-5	8-8	7-0	8-2	6-3	8-6	5-8	7-10	6-5	8-7
Spanish-American monolingual	5-9	7-8	6-0	7-3	5-6	7-10	5-5	7-7	6-7	8-5
Spanish-American bilingual	5-7	7-7	5-11	7-3	5-6	7-4	5-6	7-7	6-2	8-5
	NS NS	NS NS	.01 NS	.06 .01	.01 NS	NS NS	NS NS	NS NS	NS NS	NS NS

Note: NS means p value greater than .15

a Group main effect p value for pretest only -1968
b Group main effect p value for posttest only-1970
c Group X pretest-posttest interaction p value
d Group main effect p value for pretest-posttest analysis
e Raw score above norms

In three subtests there were group differences, but the rank order between the groups differed. On the ITPA Visual Decoding and Vocal Encoding the Spanish-American monolinguals were inferior to the other two groups of children. For the ITPA Visual-Motor Association subtest the Spanish-American bilingual children were inferior to the other children.

The results on the individual subtests suggest the following: first, after three years of schooling, Spanish-American children have a verbal comprehension deficit. This deficit comprises vocabulary, general information, verbal analogies, experience with a wide range of social situations and their corresponding rules, verbal classifying procedures, verbal similarities and differences, and grammatical form. Second, Spanish-American children do not appear to have short-term memory deficits nor appear to have problems with distractability (WISC Digit Span and ITPA Auditory-Vocal Sequencing and Visual-Motor Sequencing). Third, Spanish children are not deficient in arithmetic. Fourth, Spanish children are not deficient on what Cohen (1957) called "perceptual organization" (WISC Block Design and Object Assembly, Bender).

Bilingualism and Sexual Differences

Concerning the effects of bilingualism, the Anglo children were superior to both Spanish groups and the Spanish groups were indistinguishable on four subtests (WISC Comprehension and Vocabulary and ITPA Auditory-Vocal Association and Auditory-Vocal Automatic) and WISC Verbal IQ and ITPA Language Age. For Information and Similarities the Anglo group is distinguishable from the Spanish bilingual group and the Spanish monolinguals are in an intermediate position indistinguishable from either of the groups. Thus, the primary differences among the groups seem to be ethnic rather than bilingual differences. On the ITPA Visual Decoding, Visual-Motor Association, and Vocal Encoding, the group order may indicate some bilingual effects. However, when recalling that these three tests have the poorest test-retest stability (McCarthy and Kirk, 1963; Weener, Barritt, & Semmel, 1970), rather than interpret these differences as true bilingual differences it is probably more likely that they reflect unreliability

Sex differences did not materialize sufficiently to try to interpret them as important. The girls scored significantly lower on IQ than the boys ($p < .05$) on pretest and this effect persisted into a number of variables in the post-testing. If the kindergarten girls had also been of lower IQ than the boys instead of just the first grade girls, the sex differences would have been seen as more important; since this

was not the case, sex differences which did show up are interpreted as being a function of sampling fluctuation in the original groups.

Stability of Scores

Table 4 lists the test-retest reliability coefficients over the 26-month time period. The coefficients are affected by both error of measurement and true change over time due to the possibility of differential growth rates among the three groups. Subtests having very low coefficients were WISC Information and ITPA Visual Decoding, Visual-Motor Association, Vocal Encoding, and Visual-Motor Sequencing. Subtests with relatively high stability were WISC Block Design and ITPA Auditory-Vocal Association, Motor Encoding, Auditory-Vocal Automatic, and Auditory-Vocal Sequencing. These findings for the ITPA are similar to those of other investigators (McCarthy & Kirk; Weener, et. al.).

For the global measures, Table 4 lists the coefficients that would be expected if corrections were made for restriction of range. For purposes of comparison, Bayley (1949) found a test-retest correlation of .84 for the Stanford-Binet from age 6 to age 9. The Performance IQ stability would be expected to be lower since there were actual group changes over time. It is also interesting to note that for the WISC there was an actual restriction of range, but for the ITPA, the variance of the Language Age was greater than that listed in the ITPA manual. Restricting the range of achievement in school and of IQ did not lead to restriction of ITPA performance. This is understandable since one would expect wide differences in language ability between different ethnic and linguistic groups.

Discussion

Other Studies

When compared to Cohen's (1957) factor analytic study of the WISC, the data can be organized into primary factors of Verbal Comprehension, Perceptual Organization, and possibly Freedom from Distraction, in addition to a General Intelligence. Nonverbal measures of general intelligence are WISC Picture Arrangement and Block Design; verbal measures are Information, Comprehension, Similarities, and Vocabulary. Within this framework, Spanish primary school children are deficient on Verbal Comprehension but clearly equal on Perceptual Organization and Freedom from Distraction. These children have no deficiency in General Intelligence when it is measured nonverbally, but clearly do have deficiencies when it is measured verbally.

TABLE 4

Test-Retest Correlation Coefficients over 26 Months

Information	.29	Auditory Decoding	.43
Comprehension	.44	Visual Decoding	.15
Arithmetic	.43	Auditory-Vocal Association	.69
Vocabulary	.45	Visual-Motor Association	.30
Picture Arrangement	.40	Vocal Encoding	.33
Block Design	.58	Motor Encoding	.56
Object Assembly	.40	Auditory-Vocal Automatic	.55
Coding	.45	Auditory-Vocal Sequencing	.79
Verbal IQ	.59 (.76)	Visual-Motor Sequencing	.33
Performance IQ	.48 (.71)	Bender Gestalt	.53
Full Scale IQ	.63 (.80)	ITPA Language Age	.71 (70)

Coefficients in ( ) are corrected for restriction of range.

When compared to the original study (Killian, 1971), the Spanish-American deficit has been considerably sharpened. As kindergartners and first graders, Spanish children not only had a verbal comprehension deficit, but had difficulty with the receptive process in both auditory and visual channels and problems with sequencing and order. By the third and fourth grade the deficit seems to be only in verbal comprehension.

Comparing early primary school performance with middle primary school performance helps to clarify the findings of Darcy (1963) and the present study: she found Spanish children not to be deficient in nonverbal tasks. Our kindergarten and first graders were deficient in performance IQ but two years later this deficiency had disappeared.

Limitations

The limitations of the original study carry over into the present study. Failure to match for age and failure to get groups of boys and girls who were equal on global IQ introduce confounding effects. The extent of sex differences on these variables will have to be determined in other studies. A wider range of performance and achievement would have been more helpful. (A refinement would be to test all Ss in selected primary grades and do analyses for the total group; then, match Ss from the total group and do analyses on these matched groups.) Such a procedure would avoid the problems inherent in the "matched group fallacy" (McNemar, pp. 161-162) by providing information about the distributions of the different groups.

Implications

Keeping in mind the limitations mentioned above, the study still contains regularities which have implications for remediation of third and fourth grade Spanish-American children. There is some support for treating Spanish-American school children as a single group. If they are to be subdivided, it is probably more important to consider the whole complex of variables making up the ethnic class than just bilingualism. Parental aspiration and value system, poverty level, or restriction of experience might be more important variables than bilingualism per se.

Spanish-American school children do have cognitive deficits when compared to Anglo children. By the third grade this deficit is within the domain of verbal comprehension. Remediation should stress vocabulary, general verbal information, verbal analogies, verbal classifying procedures, similarities and differences, grammatical form, and exposure to a wide variety of social situations.

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